# TECHNICAL INSTRUCTIONS

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# 'SERIES 3' AMPLIFIERS

## INSTALLATION

### 1. GENERAL

This instruction is applicable to all 'Series 3' amplifiers: MA 15, MA 25, STA 15 and STA 25.

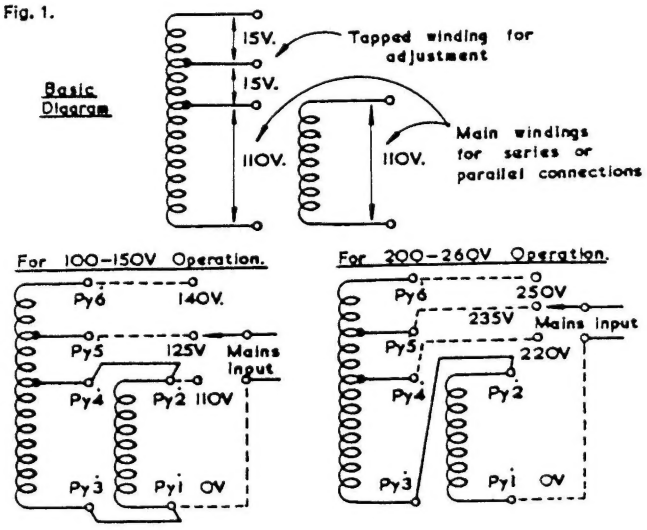
### 2. MAINS INPUT VOLTAGE SELECTION

All amplifiers are designed to operate from A.C. Mains of 100 – 140 v and 200 – 250 v., 50 – 60 c/s.

Operation in one or other of the voltage ranges is obtained by the series or parallel connection of two basic windings of 110 V, together with a supplementary winding to extend the winding by 15 V or 30 V. Thus, with the two 110 V windings in parallel the input voltage range is 0 – 110 V – 125 V – 140 V, and in the series connection 0 – 220 V – 235 V – 250 V. These are design centre values and the equipment is designed to operate on higher voltages than the design centre without overheating, and lower voltages without apparent loss of efficiency. It is recommended however, that the input voltage is within +5% or −10% of the design centre values shewn on the voltage selector dial. For example, an input supply of 240 V nominal can be used on the 235 V or 250 V position, or an input supply of 115 V nominal on the 110 V or 125 V position.

The change from one supply voltage *range* to the other is effected by a change in the connections on the transformer tag jacket, and the change within a range, by the voltage selector on the equipment. Range adjustments should be made in accordance with Fig. 1. A soldering iron is necessary for this operation which will normally be carried out by the dealer, if required. All equipments leave the factory wired for operation on the 200–250 V range unless specified otherwise.

Fig. 1.




### 3. VENTILATION

It is essential that adequate ventilation is provided. If amplifiers are fitted in enclosures, an easy air passage should be arranged to ensure convection.

### 4. MAGNETIC RADIATION

Although the amplifiers are fitted with mains transformers which have low magnetic radiation, it is advisable to take full advantage of the extremely high signal to noise ratio of the amplifiers by locating them as far as possible from magnetic pick-ups, tape heads etc. Should any trouble be encountered in this respect, a slight re-orientation of the power amplifier(s) can sometimes result in a considerable improvement.

### 5. INPUT CONNECTIONS

The signal input connection(s) to the power amplifier should be made with a single screened cable terminated by a standard phono plug to the input socket mounted on the valve chassis.

### 6. LOUDSPEAKER CONNECTIONS

Use twin cable, not less than 14/.0076" but preferably 23/.0076" from each loudspeaker, and connect to the terminals provided observing the polarity in the case of a stereo system.

### 7. OUTPUT IMPEDANCE SELECTION

All the amplifiers have an output selector switch with a choice of 4, 8 and 16 ohms impedance, and this should be adjusted to correspond with the nominal loudspeaker impedance.

### 8. EXTERNAL SUPPLY AND MAINS SWITCHING CONNECTIONS

#### 8:1 H.T. and L.T. Supplies

External power supply connections are made via an international octal valve holder and plug connector. The supplies available are:

a High tension of nominal 300–400 V D.C. at 10 mA rating,

b Low tension of nominal 6.3V A.C. at 2A rating. These supplies are intended for energising a pre-amplifier control unit.

#### 8:2 A.C. Mains and Switching

Connections to the octal socket are arranged to enable the mains supply to the power amplifier to be switched from a remote or central position, usually in the pre-amplifier.

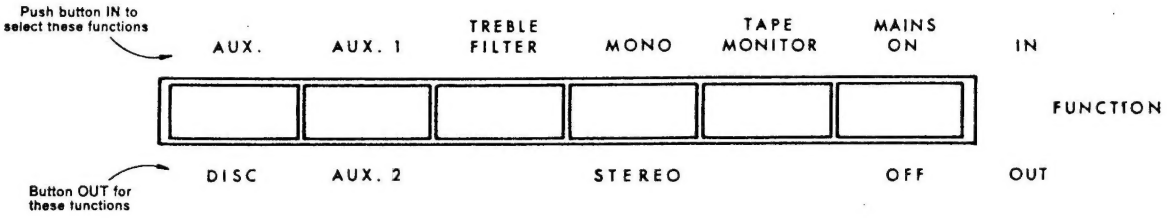
The basic arrangement is shewn in Fig. 2.

Fig. 3 shews the connections to the control unit SC2 and Fig. the connections to the SC22. In the SC2, mains connections for ancilliary equipment can be taken from the power amplifier (through a distribution unit if desired). Outlet sockets are provided on the SC22 for this purpose.

• A connecting cable is available already wired to the plug and socket for connecting the power amplifier to a control unit SC2 or SC22. These connection cable assemblies are provided with the control unit, and the amplifier only is supplied with free plug for connection to any equipment.

# PRE-AMPLIFIER CONTROL UNIT SC 2

FIG. 5 INPUT SELECTION




## 6. OPERATING THE EQUIPMENT

### 6:1 Input programme selection

This is effected by push button selection. The facilities engraved above the buttons are obtained by pushing the buttons IN. The buttons may be returned to the OUT position by depressing the button a little further to release the latch. Fig. 5 explains.

### 6:2 Balance

Under normal circumstances with identical power amplifiers and loudspeakers for each channel, the Balance control should be set to zero. Any balance off centre is suspect, and the equipment should be checked. Should any deviation from zero be necessary such as when different loudspeakers are used, the control is best adjusted when a mono record is played with a stereo pick-up. The Balance control is adjusted for the same sound output from both loudspeakers. Correct balance is then achieved and it should not be necessary to alter the position of the control again.

### 6:3 Volume Control

When the SC 2 is used with Radford power amplifiers and loudspeakers, normal domestic listening level should be obtained with the Volume control set at halfway (position 5). With the Volume control at position '8' there should be sufficient output to overload the power amplifiers. Any large deviation from these positions indicates that the input signal level is unsuited to the sensitivity of the input in use, and where possible the necessary adjustment of input level should be made.

### 6:4 Treble Filter

This filter is inserted by depressing the button marked 'Treble Filter'. It provides a graded roll-off for the high frequencies and its purpose is to attenuate high order harmonic and intermodulation distortion frequencies. When used in conjunction with the Treble tone control, this filter will enable the best possible reproduction to be obtained from any usable programme material.

The filter slope has been carefully graded to give the maximum attenuation at high frequencies without introducing transient distortion.

### 6:5 Tone Controls

The tone controls are for adjusting the balance of high and low frequencies—generally to compensate for variations in the programme material. Both controls are continuously variable. The Bass control will increase or decrease the low frequencies in relation to mid-frequencies and the Treble control will operate similarly at high frequencies. Under normal circumstances these controls should be set to their zero positions. If a setting of the tone controls greater than $\pm 3$ is found to be necessary *at all times*, the ancilliary equipment should be checked for possible faults or deficiencies.

### 6:6 Stereo-Mono Switch

With the Stereo-Mono switch in the Stereo position, separate left and right channel signals appear at the outputs. This is the normal position for stereophonic reproduction.

Where a monophonic signal only is available, this can be connected to either channel input. With the Stereo-Mono switch in the Stereo position, monophonic reproduction is obtained from the relevant channel loudspeaker. With the Stereo-Mono switch depressed, monophonic reproduction is obtained from both loudspeakers. The switch may also be used to obtain monophonic reproduction with one loudspeaker from a stereophonic input.

The monophonic position reduces the gain in each channel very slightly (less than 1 dB) due to the shunting of one amplifier channel by the other. Sometimes however, a considerable reduction in the output will be noticed on a stereophonic programme when paralleled for monophonic output. This is due to phase cancellation, and occurs when spaced microphones are used for stereophonic separation in the recording.

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Ashton Vale Estate
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Tel 662301/2

# TECHNICAL INSTRUCTIONS

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# PRE-AMPLIFIER CONTROL UNIT SC 2

## 1. INSTALLATIC

The carton contains

SC 2 Control Unit
Phono leads Pt. No. G.97—Quant. 4
Auxilliary input leads Pt. No. G.218—Quant. 2 (DIN 5 pin to 2 phono plugs)
Power lead (SC 2 to Series 3 Amplifier) Pt. No. G.220
Leaflets and Guarantee card.

The control unit may be used i[illegible] or fitted into a cabinet. For cabinet fitting a panel cut[illegible] × $3\frac{7}{16}$" is required. The outer case should be detached [illegible]ng the two 2BA screws at the rear. The unit is inserted [illegible]out from the front, and the outer cover secured to the [illegible] against the panel using the long screws provided. See Fig. 1.

Space around the unit should be provided for ventilation.

## 2. TERMINATIONS

The terminations of the control unit are as shewn in Fig. 2. Input and output facilities are detailed below:

**2:1 Input**

*2:1:1 Disc from dynamic cartridge*

Phono socket termination. Sensitivity 3–4 mV for 500 mV output. Input resistance 68 K ohms. This is suitable for all dynamic cartridges direct. Equalisation RIAA (BS 1928/1961).

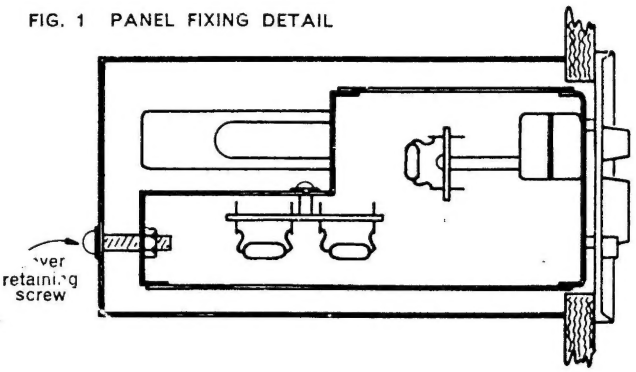
*2:1:2 Auxilliaries from tape machines, tuner, etc.*

DIN 5-pin socket termination.

Two separate switchable stereo inputs are available, both of which have a choice of input sensitivities. These inputs are suitable for a tuner, tape machine, or any other device with an output of 100–500 mV. Fig. 3 shews a general arrangement using disc, tuner, and tape machine with pre-amplifier, power amplifier, and loudspeaker. For clarity in illustration one channel only is shewn.

Leads are provided having a DIN 5-pin plug at one end and phono plugs at the other. They are wired to the lower pair of pins for sensitivies of 250 mV on Aux. 1 socket, and 500 mV on Aux. 2 socket. 100 mV and 250 mV sensitivities may be obtained from Aux. 1 and Aux. 2 sockets respectively by reconnecting the leads in the plugs to the upper pair of pins in accordance with Fig. 2. Lower sensitivities are obtainable by adding additional series resistance. (See circuit diagram Fig. 4).

FIG. 1 PANEL FIXING DETAIL




*2:1:3 Tape monitor from tape machine*

DIN 5-pin socket termination.

This input is connected direct to the power amplifier input through the tape monitor switch on the front panel. It enables the reproduction output from a 3 head tape machine to be listened to whilst recording is taking place through the pre-amplifier, from disc, tuner, or other source, and compared with that being supplied to the tape machine input. Fig. 5 illustrates the general arrangement of equipment and connections for such use.

It should be noted that the output from the tape machine is not controlled in the pre-amplifier and if the tape machine is not fitted with a reproduction output volume control, this should be provided additionally as shewn in Fig. 3.

FIG. 2 TERMINATIONS

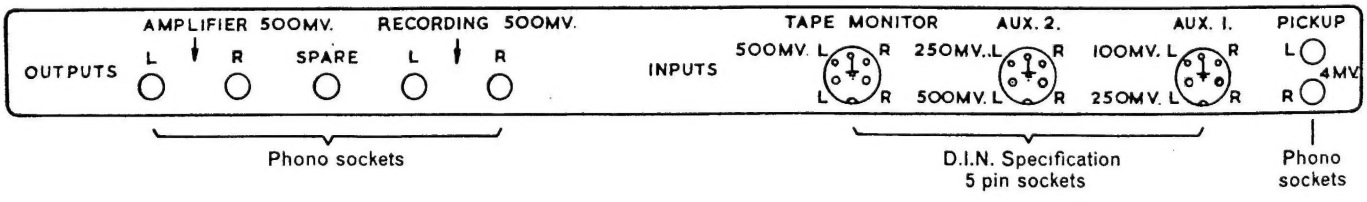
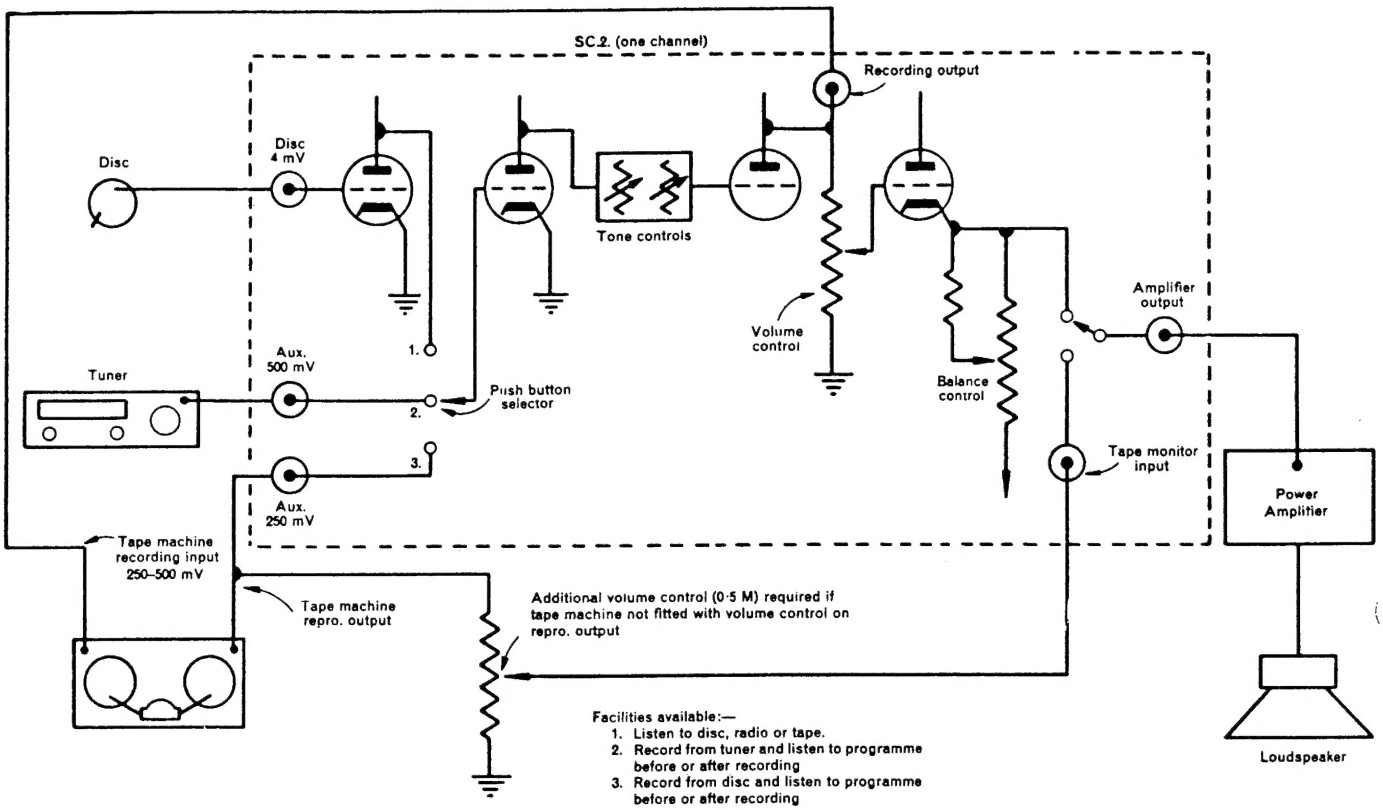


FIG. 3 GENERAL ARRANGEMENT OF CONNECTIONS FOR ANCILLIARY EQUIPMENT




**2:2 Output**

Phono socket terminations.

*2:2:1 Pre-amplifier to power amplifier(s)*

Connection from pre-amplifier to power amplifier by phono leads supplied. Pre-amplifier output is 500mV for inputs specified.

*2:2:2 Recording output to tape machine*

Phono socket terminations. The input resistance of the tape machine should not be in less than 100 K ohm to avoid loss due to shunting. (Figs. 3 and 4 refer.)

## 3. POWER SUPPLY

The SC 2 control unit does not contain a mains power unit, and requires a supply of approximately 300v 8mA and 6·3v 1·2A to energise it. A cable with connectors is supplied for use with Radford 'Series 3' amplifiers. (Pt. No. G.220). An alternative connecting cable (Pt. No. G.219) is also available for use with Mk. II amplifiers. The SC 2 may also be energised from any power amplifier having an external supply outlet with h.t. and l.t. supplies as specified above.

## 4. AUDIO CONNECTING LEADS

The following audio connecting leads are provided with each SC 2 control unit:

Pt. No. G.97 Audio lead, 4' long, phono plug each end—Quant. 4,

Pt. No. G.218 Audio lead, 4' long, phono plug to DIN 5-pin Quant. 2.

Additional leads are available from the dealer.

## 5. SETTING UP

**5:1 Hum Balance Potentiometer**

(At rear of chassis, above output terminations.)

Adjust potentiometer when switched to 'Disc' with nothing connected to the disc input sockets, and with the Bass and Volume controls set fully clockwise to maximum. Rotate the Hum Balance control for minimum hum from the loudspeakers. If the equipment is operating satisfactorily, hum should be practically inaudible even at maximum gain. If, when the pick-up is reconnected hum is heard, it will probably be due to induction into the pick-up cartridge. Remove all sources of magnetic hum field (e.g. power amplifiers) by orientation or moving to a distance sufficient to reduce the hum to an acceptable level. This assumes that the motor unit produces a low radiation field which may be checked by switching on the motor—when a slight rise in the hum level may occur.

Once set, the Hum Balance control will not need adjustment again except when a valve change occurs.

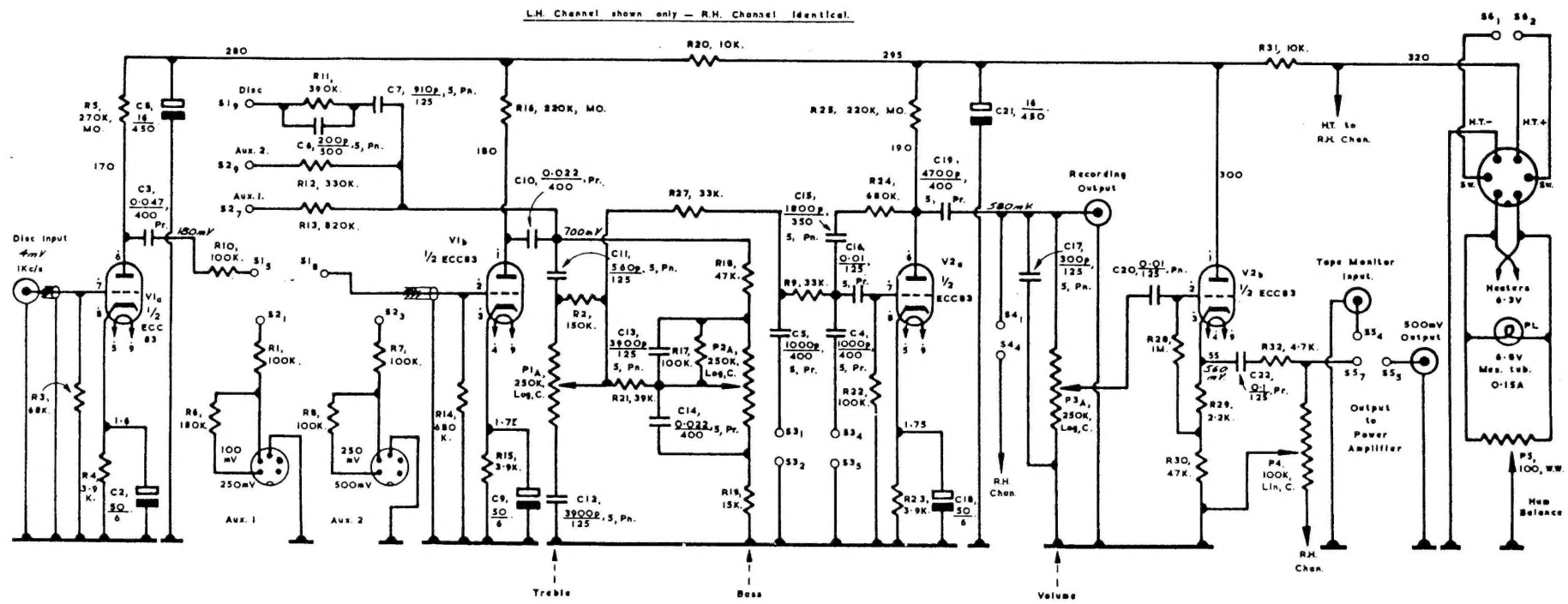
**5:2 Stereophonic direction**

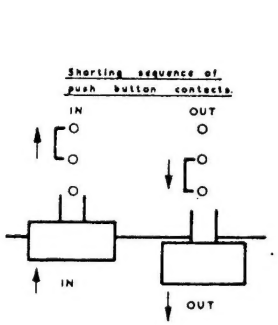
Ensure that Left and Right channels are correctly connected from the pick-up, tape machine, or tuner, through to the loudspeaker. If a stereophonic test record and test tape are available, a complete system test may be made.

**5:3 Phasing**

If the loudspeakers in a stereophonic system are not in phase, bass frequencies will be reduced by cancellation. For testing, put the loudspeakers close to each other and reverse the connections on one only. In phase, the bass frequencies will be louder than with one loudspeaker, and quieter when out of phase.

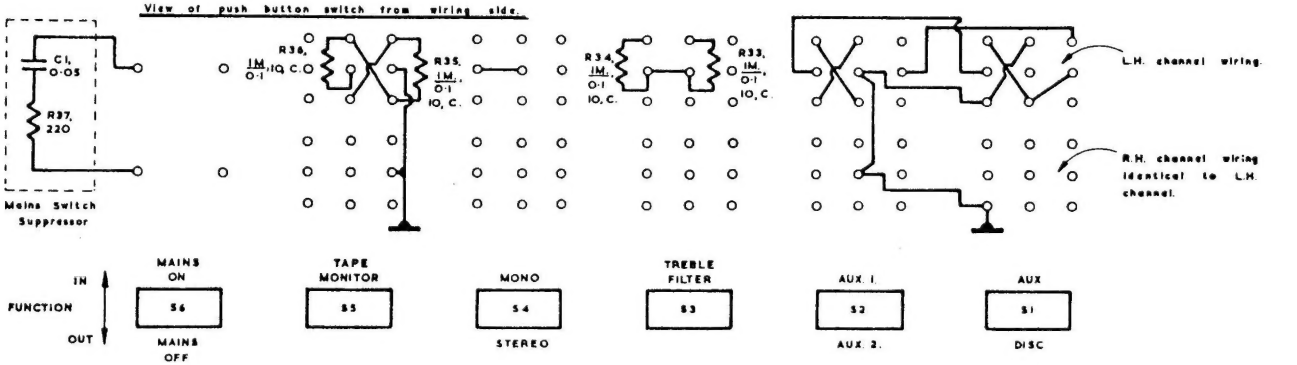
FIG. 4 CIRCUIT DIAGRAM




10 40 70
20 50 80 L.H.
30 60 90
10 40 70
20 50 80 R.H.
30 60 90

Switch contact wiring number code.




Electrolytic Capacitor

Chassis Earth

C8 & C21 in common can.

P1a P1b
P2a P2b
P3a P3b
} Dual gang

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# 'SERIES 3' AMPLIFIERS

## INSTALLATION

### 1. GENERAL

This instruction is applicable to all 'Series 3' amplifiers: MA 15, MA 25, STA 15 and STA 25.

### 2. MAINS INPUT VOLTAGE SELECTION

All amplifiers are designed to operate from A.C. Mains of 100 – 140 v and 200 – 250 v., 50 – 60 c/s.

Operation in one or other of the voltage ranges is obtained by the series or parallel connection of two basic windings of 110 V, together with a supplementary winding to extend the winding by 15 V or 30 V. Thus, with the two 110 V windings in parallel the input voltage range is 0 – 110 V – 125 V – 140 V, and in the series connection 0 – 220 V – 235 V – 250 V. These are design centre values and the equipment is designed to operate on higher voltages than the design centre without overheating, and lower voltages without apparent loss of efficiency. It is recommended however, that the input voltage is within +5% or −10% of the design centre values shewn on the voltage selector dial. For example, an input supply of 240 V nominal can be used on the 235 V or 250 V position, or an input supply of 115 V nominal on the 110 V or 125 V position.

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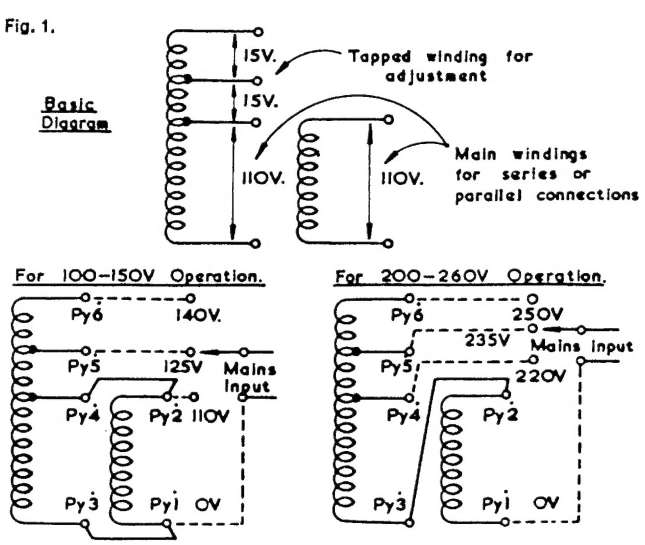
Fig. 1.




### 3. VENTILATION

It is essential that adequate ventilation is provided. If amplifiers are fitted in enclosures, an easy air passage should be arranged to ensure convection.

### 4. MAGNETIC RADIATION

Although the amplifiers are fitted with mains transformers which have low magnetic radiation, it is advisable to take full advantage of the extremely high signal to noise ratio of the amplifiers by locating them as far as possible from magnetic pick-ups, tape heads etc. Should any trouble be encountered in this respect, a slight re-orientation of the power amplifier(s) can sometimes result in a considerable improvement.

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All the amplifiers have an output selector switch with a choice of 4, 8 and 16 ohms impedance, and this should be adjusted to correspond with the nominal loudspeaker impedance.

### 8. EXTERNAL SUPPLY AND MAINS SWITCHING CONNECTIONS

#### 8:1 H.T. and L.T. Supplies

External power supply connections are made via an international octal valve holder and plug connector. The supplies available are:

a High tension of nominal 300–400 V D.C. at 10 mA rating,

b Low tension of nominal 6.3V A.C. at 2A rating. These supplies are intended for energising a pre-amplifier control unit.

#### 8:2 A.C. Mains and Switching

Connections to the octal socket are arranged to enable the mains supply to the power amplifier to be switched from a remote or central position, usually in the pre-amplifier.

The basic arrangement is shewn in Fig. 2.

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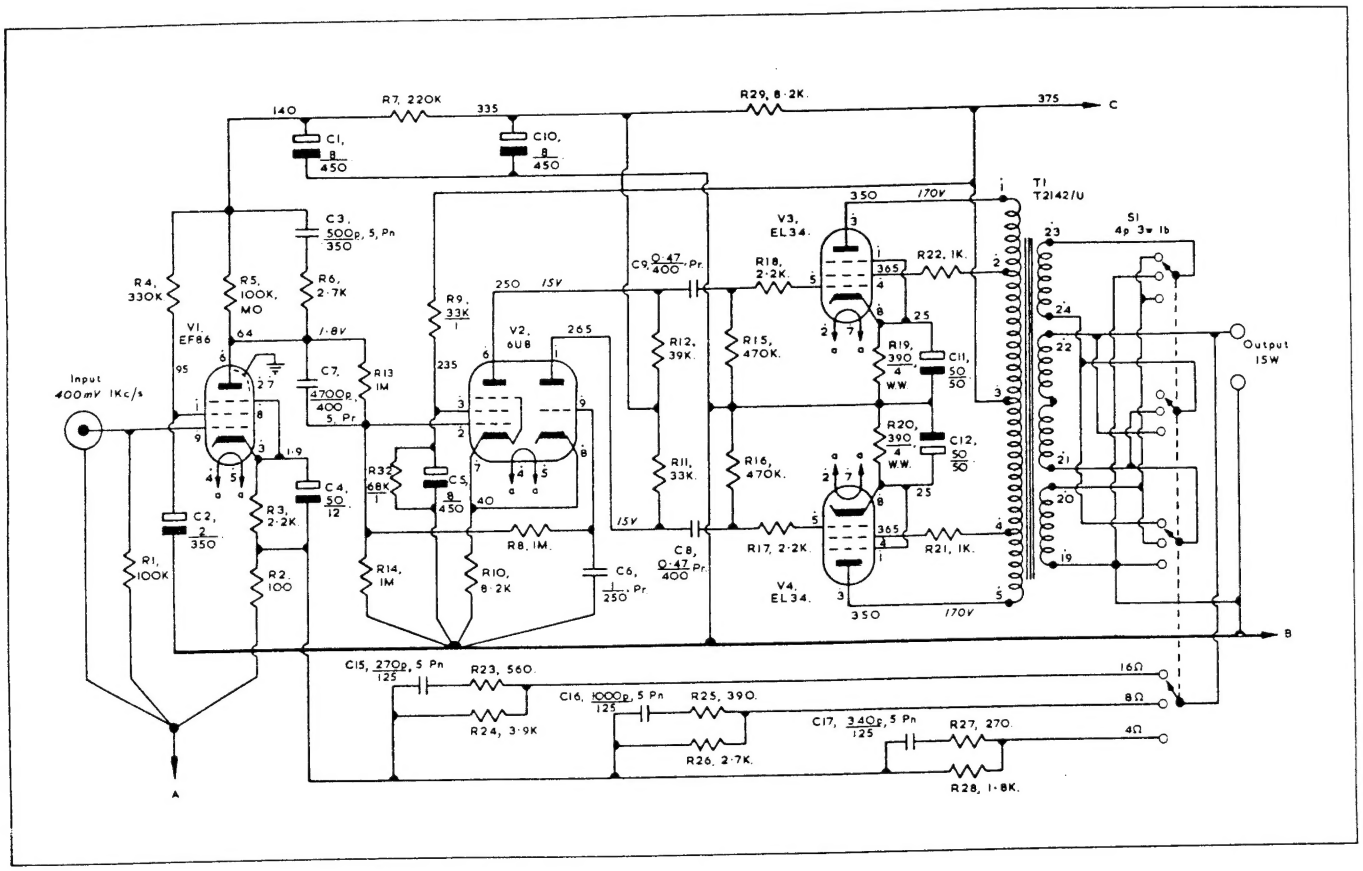
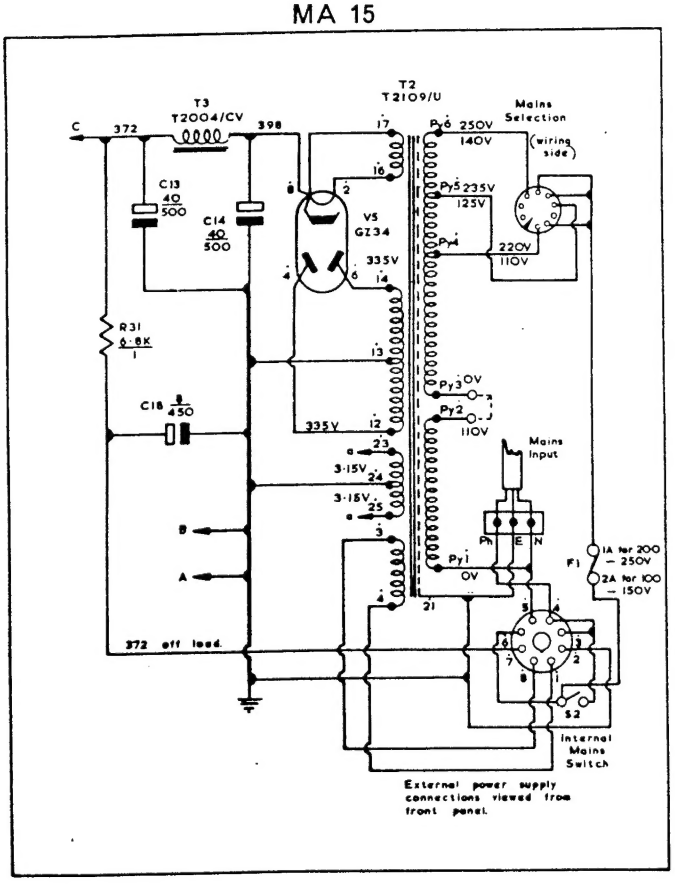
## BASIC AMPLIFIER CIRCUIT 15 WATTS

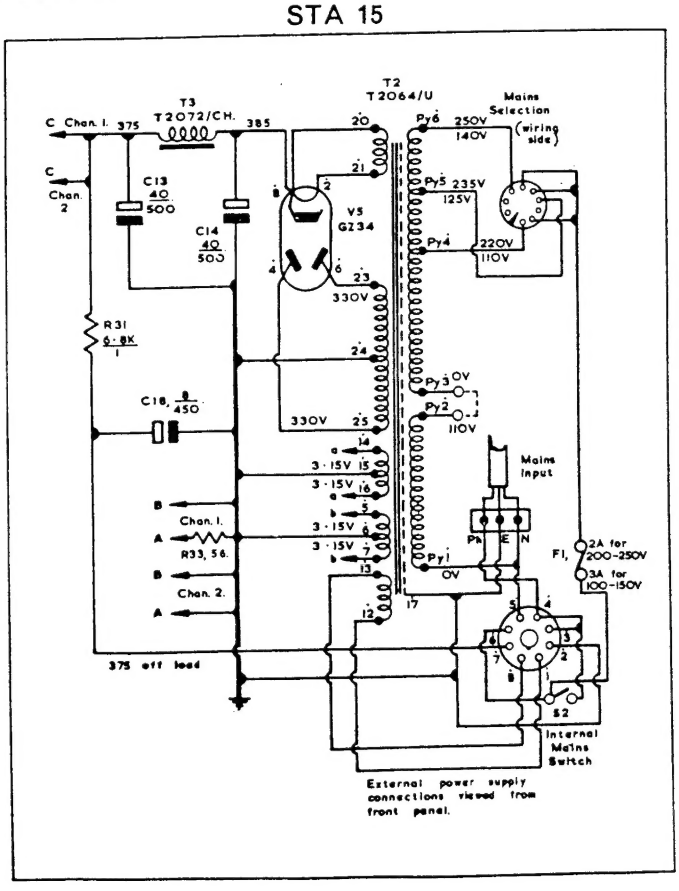



## POWER SUPPLY

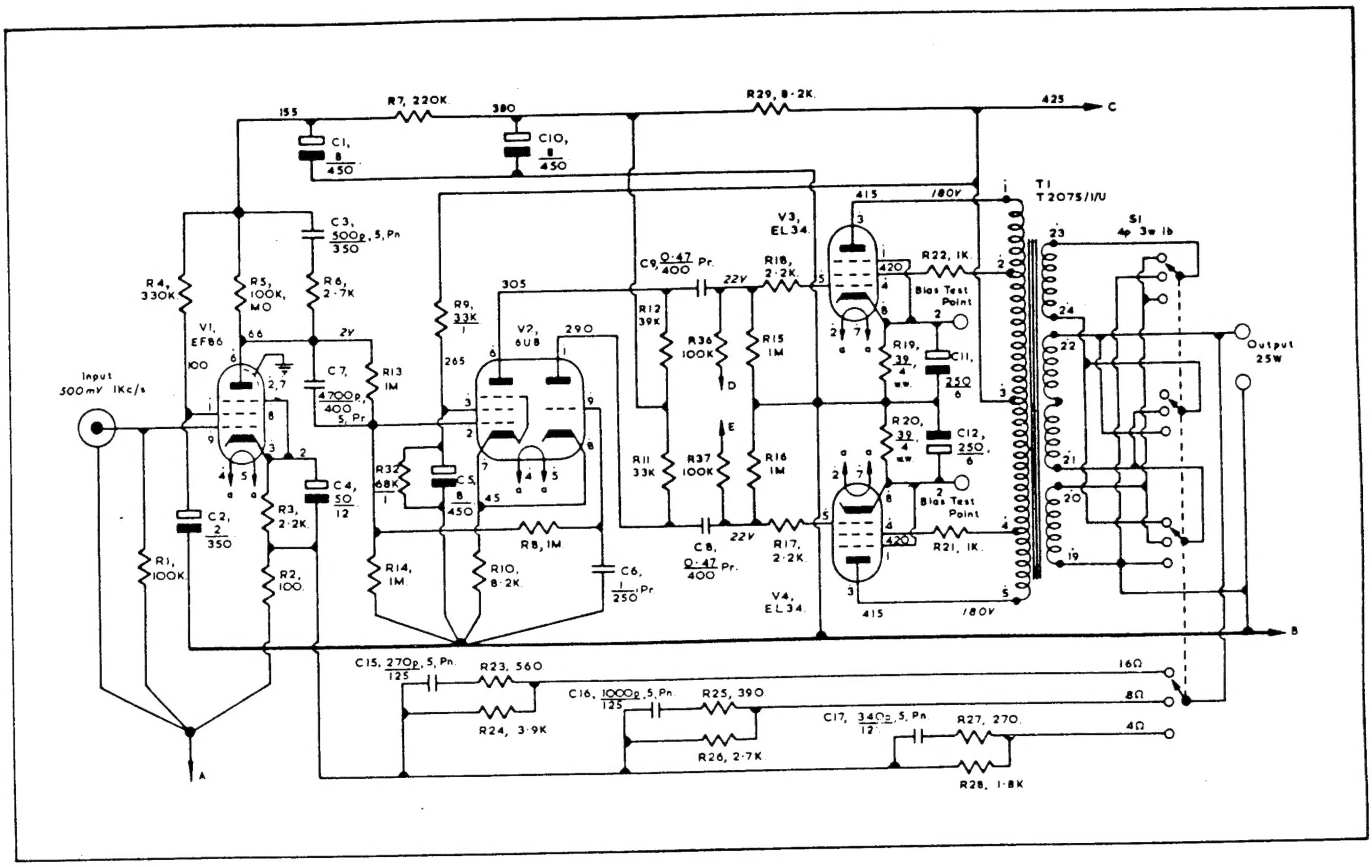
### MA 15




### STA 15

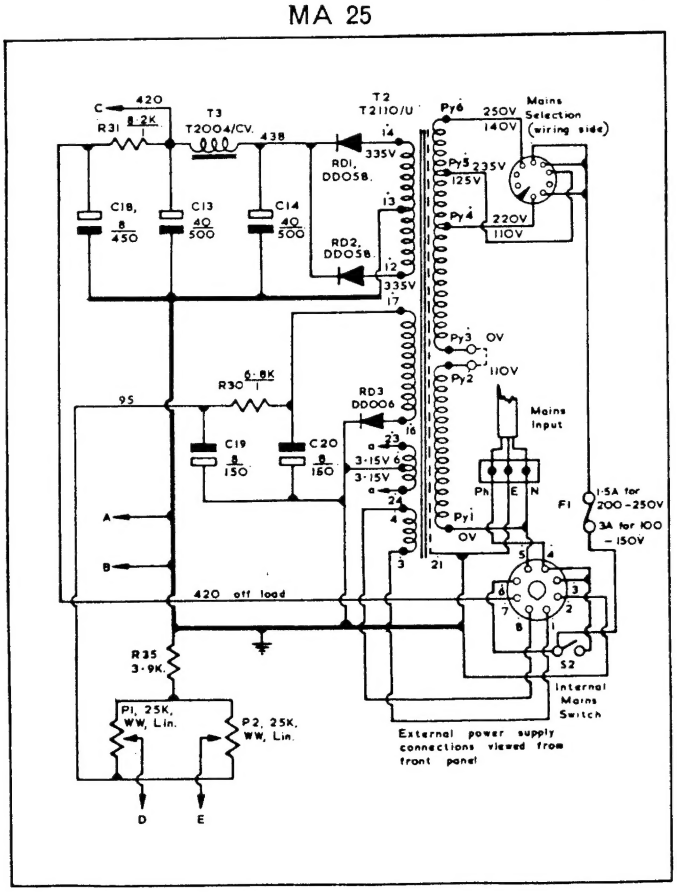


## BASIC AMPLIFIER CIRCUIT 25 WATTS

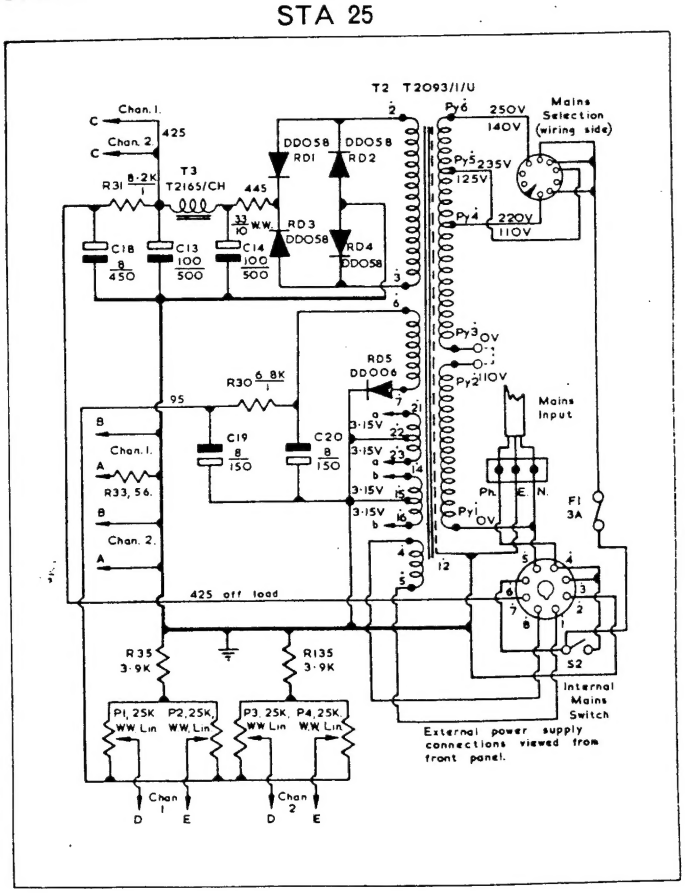



## POWER SUPPLY

### MA 25




### STA 25



## 9. MAINTENANCE

### 9:1 Bias adjustment

MA25 and STA25 amplifiers obtain bias for the output valves from a power supply provided specially for this purpose. It is adjustable by the slotted spindle potentiometers behind the anodised aluminium panel at the rear of the chassis. This will rarely need adjustment once set but a check occasionally will indicate the wear of the output valves. The potentiometers should be adjusted for a reading of 2 volts from the test point to the chassis.

Fig. 2. BASIC CONNECTIONS OF EXTERNAL POWER SOCKET

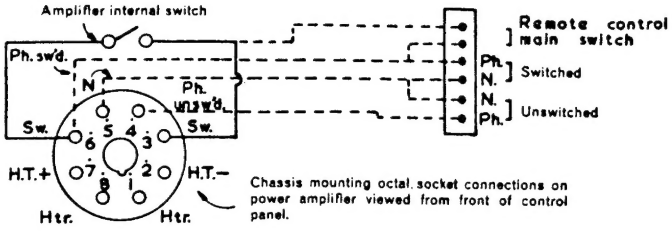



Fig. 3. EXTERNAL SUPPLY CONNECTION ARRANGEMENTS FOR SC2 CONTROL UNIT

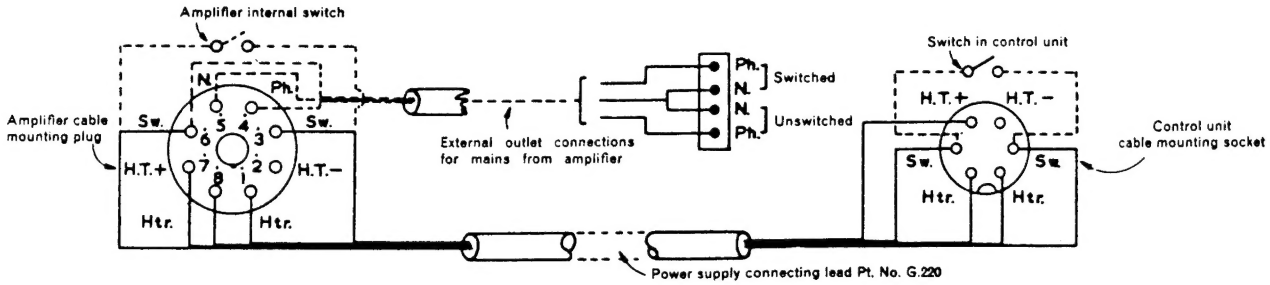
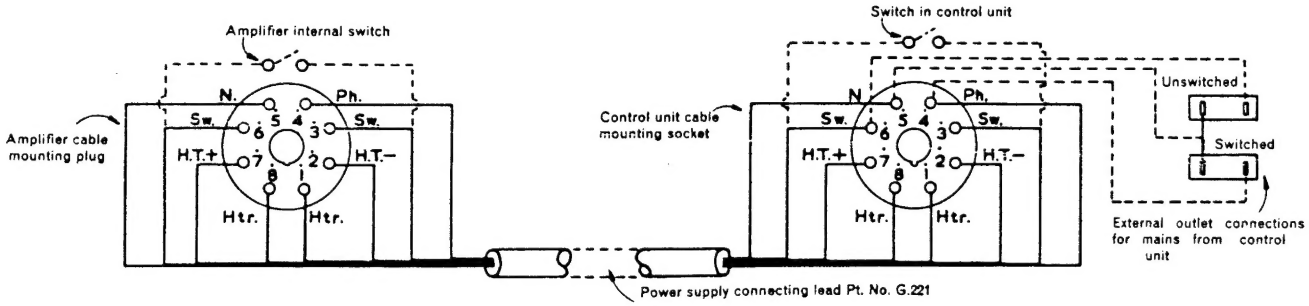



Fig. 4. EXTERNAL SUPPLY CONNECTION ARRANGEMENTS FOR SC22 CONTROL UNIT




### 9:2 Life expectancy of component parts

As a guide to frequency of replacements, the possible life of parts used in Radford equipment is given below.

*9:2:1 Valves*

The valves most likely to require replacement first are those consuming power, i.e. rectifiers and power output valves. Power output valves in Radford amplifiers are deliberately under-run for many reasons, one of which is long life. If amplifiers are used for some hours every day the emission life should be approximately 2–3 years for power and rectifier valves and about 7 years for other valves. This excludes the possibility of an absolute failure of any type of valve.

*9:2:2 Fuses*

Fuses wear thin and may "blow" after a few years use. This does not imply any fault in the equipment, but if fuses need frequent replacement the equipment should be checked. The fuses used in Series 3 amplifiers are:—

| | MA 15 | STA 15 | MA 25 | STA 25 |
|---|---|---|---|---|
| Mains Primary Fuse | | | | |
| 100/140 v Range | 2A | 3A | 2.5A | 3.0A |
| 200/250 v Range | 1A | 2A | 1.5A | 2.5A |

*9:2:3 Electrolytic capacitors*

Providing equipment is regularly used, the life should be a minimum of 10 years.

*9:2:4 Transformers*

Transformers are designed on a Class "A" rating basis with a life expectancy of 21 years continuous duty. Deterioration of the insulating materials takes place as a function of temperature and time. If the transformer is over-run due to the failure of a valve or other components the life expectancy may be reduced.

*9:2:5 Other Components*

All other components have a considerable life potential but absolute failure is a possibility at any time, although remote.

### 9:3 Service adjustments

*9:3:1 Replacements of parts*

The service of amplifiers is very simple for the experienced mechanic or technician. Component boards are printed with the circuit references. The 'Technical Instruction' T.I (A) 1. should be studied to enable the circuit diagrams to be properly understood.

*9:3:2 Checking performance characteristics*

The performance characteristics given in the sales leaflet can be measured providing suitable apparatus is available. Technical instructions are being prepared to shew how the tests should be carried out. They will be available to Dealers on request.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